AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings of claims in the application:

Claim 1 (currently amended): A computer implemented method for compressing a file of an animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model for corresponding reference vertices of a reference model for a first frame of the animation cycle and associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

determining differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

storing as a compressed file in a database the reference model and differences between the predicted offset vertices and actual offset vertices to allow reconstruction of the actual offset vertices using the reference vertices and the differences for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i,k-1}$, $P_{i+1,k-1}$, $P_{i+1,k-2}$ where the reference vertex is $P_{i,k}$, and is in an odd row of the surface.

Claim 2 (original): The method of claim 1, wherein at least one basis coordinate system comprises a set of vertices that are either seed vertices or vertices previously traversed.

Claim 3 (original): The method of claim 1, wherein at least one basis coordinate system is a triangle defined by three vertices nearby the reference vertex.

Claim 4 (original): The method of claim 1, wherein at least one basis coordinate system comprises a preconfigured triangle based on a location of the reference vertex.

Claim 5 (canceled)

Claim 6 (currently amended): ~~The method of claim 1,~~ A computer implemented method for compressing a file of an animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model for corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

determining differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

storing as a compressed file in a database the reference model and the differences between the predicted offset vertices and actual offset vertices to allow reconstruction of the actual offset vertices using the reference vertices and the differences for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i,k-1}$, $P_{i,k-2}$, where the reference vertex is $P_{i,k}$, and is in an even row of the surface.

Claim 7 (currently amended): ~~The method of claim 1,~~ A computer implemented method for compressing a file of an animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model for corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

determining differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

storing as a compressed file in a database the reference model and the differences between the predicted offset vertices and actual offset vertices to allow reconstruction of the actual offset vertices using the reference vertices and the differences for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i-1,k}$, $P_{i-2,k}$, where the reference vertex is $P_{i,k}$, and is in a last row of the surface.

Claim 8 (currently amended): ~~The method of claim 1~~, A computer implemented method for compressing a file of an animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model for corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

determining differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

storing as a compressed file in a database the reference model and the differences between the predicted offset vertices and actual offset vertices to allow reconstruction of the actual offset vertices using the reference vertices and the differences for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k}$, $P_{i,k+1}$, $P_{i-2,k+1}$, where the reference vertex is $P_{i,k}$, and is the leftmost vertex in a last and odd row of the surface.

Claim 9 (original): The method of claim 1, wherein predicting offset vertices comprises for each offset vertex:

selecting a reference vertex on the reference model and a corresponding offset vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model.

Claim 10 (original): The method of claim 9, wherein selecting a reference vertex on the reference model comprises traversing the surface of the reference model in a zig-zag pattern.

Claim 11 (original): The method of claim 9, wherein predicting the offset vertex comprises:

determining a reference vector for the position of the reference vertex in the basis coordinate system on the reference model; and

determining a corresponding offset vector for the reference vertex in the basis coordinate system of the offset model.

Claim 12 (currently amended): ~~The method of claim 9,~~ A computer implemented method for compressing a file of an animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model for corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

determining differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

storing as a compressed file in a database the reference model and the differences between the predicted offset vertices and actual offset vertices to allow reconstruction of the actual offset vertices using the reference vertices and the differences for each subsequent frame of the animation cycle;

wherein predicting offset vertices comprises for each offset vertex:

selecting a reference vertex on the reference model and a corresponding offset vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

wherein predicting the offset vertex comprises determining the offset vertex $P'_{i,k}$ from the equation:

$$\vec{P'}_{i,k} = \left(\vec{P}_{i,k} - \vec{A}\right) * \begin{bmatrix} \vec{s} \\ \vec{t} \\ \vec{r} \end{bmatrix}^{-1} \begin{bmatrix} \vec{s'} \\ \vec{t'} \\ \vec{r'} \end{bmatrix} + \vec{A'}$$

where:

$P_{i,k}$ is the reference vertex in the world space of the reference model;

A, B, C are vertices of the basis coordinate system in the world space of the reference model, and

s=B-A, *t*=C-A, and *r* is normal to *s* and *t*, and has a length equal to the average length of *s* and *t*;

A', B', C' are vertices of the basis coordinate system in the world space of the offset model, and

s'=B'-A', *t'*=C'-A', and *r'* is normal to *s'* and *t'*, and has a length equal to the average length of *s'* and *t'*.

Claim 13 (original): The method of claim 1, further comprising:

selecting seed vertices; and

quantizing the seed vertices.

Claim 14 (original): The method of claim 1, wherein predicting offset vertices comprises traversing the surface of the reference model in a zig-zag pattern.

Claim 15 (original): The method of claim 1, wherein predicting offset vertices comprises traversing the surface of the reference model in a hierarchical traversal pattern.

Claim 16 (original): The method of claim 1, wherein predicting offset vertices comprises traversing the surface of the reference model in a triangle-based traversal pattern.

Claim 17 (original): The method of claim 1, further comprising quantizing the differences.

Claim 18 (currently amended): ~~The method of claim 1,~~ A computer implemented method for compressing a file of an animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model for corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

determining differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

storing as a compressed file in a database the reference model and the differences between the predicted offset vertices and actual offset vertices to allow reconstruction of the actual offset vertices using the reference vertices and the differences for each subsequent frame of the animation cycle; wherein each difference comprises a vector having vector components, each vector component associated with an axis of a coordinate system, further comprising:

reordering vector components of the difference so that vector components associated with each axis are stored contiguously.

Claim 19 (original): The method of claim 1, wherein storing the differences comprises compressing the differences into a compressed data set using an entropy based compression algorithm.

Claim 20 (original): The method of claim 1, further comprising compressing seed vertices using an entropy based compression algorithm.

Claim 21 (currently amended): A computer implemented method for compressing a file of an animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle and associated with the offset model, and for each reference vertex:

selecting an offset vertex of the offset model corresponding to the reference vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

determining a difference between the predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation model; and

storing as a compressed file in a database the reference model and the difference between the predicted offset vertex and actual offset vertex for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i,k-1}$, $P_{i+1,k-1}$, $P_{i+1,k-2}$ where the reference vertex is $P_{i,k}$, and is in an odd row of the surface.

Claim 22 (original): The method of claim 21, wherein at least one basis coordinate system comprises a set of vertices that are either seed vertices or vertices previously traversed.

Claim 23 (original): The method of claim 21, wherein at least one basis coordinate system is a triangle defined by three vertices nearby the reference vertex.

Claim 24 (original): The method of claim 21, wherein at least one basis coordinate system comprises a preconfigured triangle based on a location of the reference vertex.

Claim 25 (canceled)

Claim 26 (currently amended): ~~The method of claim 21,~~ A computer implemented method for compressing a file of an animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

selecting an offset vertex of the offset model corresponding to the reference vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

determining a difference between the predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation model; and

storing as a compressed file in a database the reference model and the difference between the predicted offset vertex and actual offset vertex for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i,k-1}$, $P_{i,k-2}$, where the reference vertex is $P_{i,k}$, and is in an even row of the surface.

Claim 27 (currently amended): ~~The method of claim 21,~~ A computer implemented method for compressing a file of an animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the reference model and associated with the offset model, and for each reference vertex:

selecting an offset vertex of the offset model corresponding to the reference vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

determining a difference between the predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation model; and

storing as a compressed file in a database the reference model and the difference between the predicted offset vertex and actual offset vertex for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i-1,k}$, $P_{i-2,k}$, where the reference vertex is $P_{i,k}$, and is in a last row of the surface.

Claim 28 (currently amended): ~~The method of claim 21,~~ A computer implemented method for compressing a file of an animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the reference model and associated with the offset model, and for each reference vertex:

selecting an offset vertex of the offset model corresponding to the reference vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

determining a difference between the predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation model; and

storing as a compressed file in a database the reference model and the difference between the predicted offset vertex and actual offset vertex for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k}$, $P_{i,k+1}$, $P_{i-2,k+1}$, where the reference vertex is $P_{i,k}$, and is the leftmost vertex in a last and odd row of the surface.

Claim 29 (original): The method of claim 21, wherein predicting the offset vertex comprises:

determining a reference vector for the position of the reference vertex in the basis coordinate system on the reference model; and

determining a corresponding offset vector for the reference vertex in the basis coordinate system of the offset model.

Claim 30 (currently amended): ~~The method of claim 21,~~ A computer implemented method for compressing a file of an animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the reference model and associated with the offset model, and for each reference vertex:

selecting an offset vertex of the offset model corresponding to the reference vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

determining a difference between the predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation model; and

storing as a compressed file in a database the reference model and the difference between the predicted offset vertex and actual offset vertex for each subsequent frame of the animation cycle;

wherein predicting the offset vertex comprises determining the offset vertex $P'_{i,k}$ from the equation:

$$\vec{P}'_{i,k} = \left(\vec{P}_{i,k} - \vec{A}\right) * \begin{bmatrix} \vec{s} \\ \vec{t} \\ \vec{r} \end{bmatrix}^{-1} \begin{bmatrix} \vec{s}' \\ \vec{t}' \\ \vec{r}' \end{bmatrix} + \vec{A}'$$

where:

$P_{i,k}$ is the reference vertex in the world space of the reference model;

A, B, C are vertices of the basis coordinate system in the world space of the reference model, and

s=B-A, *t*=C-A, and *r* is normal to *s* and *t*, and has a length equal to the average length of *s* and *t*;

A', B', C' are vertices of the basis coordinate system in the world space of the offset model, and

s'=B'-A', *t'*=C'-A', and *r'* is normal to *s'* and *t'*, and has a length equal to the average length of *s'* and *t'*.

Claim 31 (original): The method of claim 1, further comprising:
selecting seed vertices; and
quantizing the seed vertices.

Claim 32 (original): The method of claim 21, wherein traversing a plurality of reference vertices comprises traversing the reference vertices in a zig-zag pattern.

Claim 33 original): The method of claim 21, wherein traversing a plurality of reference vertices comprises traversing the reference vertices in a zig-zag pattern between adjacent rows of reference vertices.

Claim 34 (original): The method of claim 21, wherein traversing a plurality of reference vertices comprises traversing the surface of the reference model in a hierarchical traversal pattern.

Claim 35 (original): The method of claim 21, wherein traversing a plurality of reference vertices comprises traversing the surface of the reference model in a triangle-based traversal pattern.

Claim 36 (original): The method of claim 21, wherein storing the difference between the predicted offset vertex and actual offset vertex comprises quantizing the difference before storing.

Claim 37 (currently amended): ~~The method of claim 21,~~ A computer implemented method for compressing a file of an animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the reference model and associated with the offset model, and for each reference vertex:

selecting an offset vertex of the offset model corresponding to the reference vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model;

determining a difference between the predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation model; and

storing as a compressed file in a database the reference model and the difference between the predicted offset vertex and actual offset vertex for each subsequent frame of the animation cycle; wherein storing the difference between the predicted offset vertex and actual offset vertex comprises reordering vector components of the difference so that vector components associated with each axis are stored contiguously.

Claim 38 (original): The method of claim 21, wherein storing the difference between the predicted offset vertex and actual offset vertex comprises compressing the difference into a compressed data set using an entropy based compression algorithm.

Claim 39 (original): The method of claim 21, further comprising compressing seed vertices using an entropy based compression algorithm.

Claim 40 (currently amended): A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle and associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the retrieved differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i,k-1}$, $P_{i+1,k-1}$, $P_{i+1,k-2}$ where the reference vertex is $P_{i,k}$, and is in an odd row of the surface.

Claim 41 (original): The method of claim 40, wherein at least one basis coordinate system comprises a set of vertices that are either seed vertices or vertices previously traversed.

Claim 42 (original): The method of claim 40, wherein at least one basis coordinate system is a triangle defined by three vertices nearby the reference vertex.

Claim 43 (original): The method of claim 40, wherein at least one basis coordinate system comprises a preconfigured triangle based on a location of the reference vertex.

Claim 44 (canceled)

Claim 45 (currently amended): ~~The method of claim 40,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model

including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i,k-1}$, $P_{i,k-2}$, where the reference vertex is $P_{i,k}$, and is in an even row of the surface.

Claim 46 (currently amended): ~~The method of claim 40,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i-1,k}$, $P_{i-2,k}$, where the reference vertex is $P_{i,k}$, and is in a last row of the surface.

Claim 47 (currently amended): ~~The method of claim 40,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k}$, $P_{i,k+1}$, $P_{i-2,k+1}$, where the reference vertex is $P_{i,k}$, and is the leftmost vertex in a last and odd row of the surface.

Claim 48 (original): The method of claim 40, wherein predicting offset vertices comprises for each offset vertex:

selecting a reference vertex on the reference model and a corresponding offset vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model.

Claim 49 (original): The method of claim 48, wherein predicting the offset vertex, comprises:

determining a reference vector for the position of the reference vertex in the basis coordinate system on the reference model; and

determining a corresponding offset vector for the reference vertex in the basis coordinate system of the offset model.

Claim 50 (currently amended): ~~The method of claim 48,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; wherein predicting the offset vertex, comprises determining the offset vertex $P'_{i,k}$ from the equation:

$$\vec{P'}_{i,k} = \left(\vec{P}_{i,k} - \vec{A}\right) * \begin{bmatrix} \vec{s} \\ \vec{t} \\ \vec{r} \end{bmatrix}^{-1} \begin{bmatrix} \vec{s'} \\ \vec{t'} \\ \vec{r'} \end{bmatrix} + \vec{A'}$$

where:

$P_{i,k}$ is the reference vertex in the world space of the reference model;

A, B, C are vertices of the basis coordinate system in the world space of the reference model, and

s=B-A, t=C-A, and r is normal to s and t, and has a length equal to the average length of s and t;

A', B', C' are vertices of the basis coordinate system in the world space of the offset model, and

s'=B'-A', t'=C'-A', and r' is normal to s' and t', and has a length equal to the average length of s' and t'.

Claim 51 (currently amended): ~~The method of claim 40,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; wherein retrieving from the compressed animation model stored differences comprises:

reordering vector components of the differences from being continuously stored for each axis of a coordinate system to being grouped into coordinate tuple form.

Claim 52 (currently amended): ~~The method of claim 40,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; retrieving from the compressed animation model stored differences comprises decompressing the differences into an uncompressed form using an entropy based decompression algorithm.

Claim 53 (currently amended): ~~The method of claim 40,~~ A computer implemented method for decompressing a compressed animation model file for an automation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

predicting offset vertices of the offset model from corresponding reference vertices of a reference model for a first frame of the animation cycle associated with the offset model, using basis coordinate systems respectively associated with the reference vertices;

retrieving from a database the compressed animation model file, previously stored differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle; and

combining the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; further comprising decompressing seed vertices into an uncompressed form using an entropy based decompression algorithm, and using the seed vertices as a reference vertices.

Claim 54 (original): The method of claim 40, wherein predicting offset vertices comprises traversing the surface of the reference model in a zig-zag pattern.

Claim 55 (original): The method of claim 40, wherein predicting offset vertices comprises traversing the surface of the reference model in a hierarchical traversal pattern.

Claim 56 (original): The method of claim 40, wherein predicting offset vertices comprises traversing the surface of the reference model in a triangle based traversal pattern.

Claim 57 (currently amended): A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle and associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted, offset vertex and the retrieved difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i,k-1}$, $P_{i+1,k-1}$, $P_{i+1,k-2}$ where the reference vertex is $P_{i,k}$, and is in an odd row of the surface.

Claim 58 (original): The method of claim 57, wherein at least one basis coordinate system comprises a set of vertices that are either seed vertices or vertices previously traversed.

Claim 59 (original): The method of claim 57, wherein at least one basis coordinate system is a triangle defined by three vertices nearby the reference vertex.

Claim 60 (original): The method of claim 57, wherein at least one basis coordinate system comprises a preconfigured triangle based on a location of the reference vertex.

Claim 61 (canceled)

Claim 62 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i,k-1}$, $P_{i,k-2}$, where the reference vertex is Pi k, and is in an even row of the surface.

Claim 63 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality

of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k-1}$, $P_{i-1,k}$, $P_{i-2,k}$, where the reference vertex is Pi k, and is in a last row of the surface.

Claim 64 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein at least one basis coordinate system comprises a triangle defined by the vertices $P_{i-1,k}$, $P_{i,k+1}$, $P_{i-2,k+1}$, where the reference vertex is $P_{i,k}$, and is the leftmost vertex in a last and odd row of the surface.

Claim 65 (original): The method of claim 57, wherein predicting the offset vertex, comprises:

determining a reference vector for the position of the reference vertex in the basis coordinate system on the reference model; and

determining a corresponding offset vector for the reference vertex in the basis coordinate system of the offset model.

Claim 66 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein predicting the offset vertex, comprises determining the offset vertex $P'_{i,k}$ from the equation:

$$\vec{P'}_{i,k} = \left(\vec{P}_{i,k} - \vec{A}\right) * \begin{bmatrix} \vec{s} \\ \vec{t} \\ \vec{r} \end{bmatrix}^{-1} \begin{bmatrix} \vec{s'} \\ \vec{t'} \\ \vec{r'} \end{bmatrix} + \vec{A'}$$

where:

$P_{i,k}$ is the reference vertex in the world space of the reference model;

A, B, C are vertices of the basis coordinate system in the world space of the reference model, and

s=B-A, t=C-A, and r is normal to s and t, and has a length equal to the average length of s and t;

A', B', C' are vertices of the basis coordinate system in the world space of the offset model, and

s'=B'-A', t'=C'-A', and r' is normal to s' and t', and has a length equal to the average length of s' and t'.

Claim 67 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality

of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein retrieving from the compressed animation model a stored difference comprises:

reordering vector components of the difference from being continuously stored for each axis of a coordinate system to being grouped into coordinate tuple form.

Claim 68 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; wherein retrieving from the compressed animation model a stored difference comprises decompressing the difference into an uncompressed form using an entropy based decompression algorithm.

Claim 69 (currently amended): ~~The method of claim 57,~~ A computer implemented method for decompressing a compressed animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the method comprising:

traversing a plurality of reference vertices on a surface of a reference model for a first frame of the animation cycle associated with the offset model, and for each reference vertex:

retrieving from a database for the compressed animation model file a previously stored difference between a predicted offset vertex and an actual offset vertex of the offset model for each subsequent frame of the animation cycle;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system on the reference model;

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model; and

combining the predicted offset vertex and the stored difference to produce a final offset vertex of the offset model for each subsequent frame of the animation cycle; further comprising decompressing a seed vertex into an uncompressed form using an entropy based decompression algorithm, and using the seed vertex as a reference vertex.

Claim 70 (original): The method of claim 57, wherein traversing a plurality of reference vertices comprises traversing the surface of the reference model in a zig-zag pattern.

Claim 71 (original): The method of claim 57, wherein traversing a plurality of reference vertices comprises traversing the surface of the reference model in a hierarchical traversal pattern.

Claim 72 (original): The method of claim 57, wherein traversing a plurality of reference vertices comprises traversing the surface of the reference model in a triangle-based traversal pattern.

Claim 73 (currently amended): A computer program product, comprising a computer readable medium carrying code for storing as a compressed file in a database a compressed, offset animation model file for an animation cycle comprising a plurality of frames of animation of the animation model, the model comprising:

a plurality of seed vertices, each seed vertex corresponding to a row of reference vertices on a surface of a reference model for a first frame of the animation cycle and associated with the offset model, the seed vertices for predicting a plurality of offset vertices on a surface of the offset model; and

a plurality of differences between predicted offset vertices and actual offset vertices for each subsequent frame of the animation cycle, for combining with the plurality of offset vertices predicted from the seed vertices to produce a plurality of final offset vertices on the surface of the offset model for each subsequent frame of the animation model; wherein the differences comprise vector components of coordinate tuples, and the vector components for each axis of a coordinate system are stored continuously.

Claim 74 (original): The computer program product of claim 73, wherein the seed vertices are stored in quantized form.

Claim 75 (original): The computer program product of claim 73, wherein the differences are stored in quantized form.

Claim 76 (canceled)

Claim 77 (original): The computer program product of claim 73, wherein the seed vertices are stored in compressed form from an entropy based compression algorithm.

Claim 78 (original): The computer program product of claim 73, wherein the differences are stored in compressed, form from an entropy-based compression algorithm.

Claim 79 (currently amended): A system for compressing an animation model for an animation cycle comprising a plurality of frames of an animation cycle of the animation model, the model comprising an offset model including a plurality of surfaces, each surface including a plurality of vertices, the system comprising:

a model database that stores a reference model for a first frame of the animation cycle; and

a geometry compression module that predicts offset vertices of the offset model for corresponding reference vertices of the reference model associated with the offset model, using basis coordinate systems respectively associated with the reference vertices, determines differences between the predicted offset vertices and actual offset vertices of the offset model for each subsequent frame of the animation cycle, and stores the reference model and differences between the predicted offset vertices and actual offset vertices as a compressed offset model in the model database to allow reconstruction of the actual offset vertices using the reference vertices and the differences; each difference comprises a vector having vector components, each vector component associated with an axis of a coordinate system, the system further comprising:

a data reordering module that reorders the vector components of the differences so that vector components associated with each axis are stored contiguously.

Claim 80 (original): The system of claim 79, further comprising:

a quantization module that quantizes the differences prior to storing in the compressed offset model.

Claim 81 (canceled)

Claim 82 (original): The system of claim 79, further comprising:

a data compression module that compresses the differences using an entropy based compression algorithm prior to storing in the compressed offset model.

Claim 83 (original): The system of claim 79, wherein the geometry compression module predicts offset vertices by:

selecting a reference vertex on the reference model and a corresponding offset vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model.

Claim 84 (currently amended): A system for decompressing a compressed animation model for an animation cycle comprising a plurality of frames of animation of the animation model, the model representing an offset model including a plurality of surfaces, each surface including a plurality of vertices, the system comprising:

a model database that stores a reference model for a first frame of the animation model and a compressed animation model; and

a geometry decompression module that predicts offset vertices of the offset model from corresponding reference vertices of the reference model associated with the offset model for each subsequent frame of the animation cycle, using basis coordinate systems respectively associated with the reference vertices, retrieves from the compressed animation model stored differences between the predicted offset vertices and actual offset vertices of the offset model, and combines the predicted offset vertices and the stored differences to produce the offset vertices of the offset model for each subsequent frame of the animation cycle; further comprising:

a data reordering module that reorders vector components of the differences from being continuously stored for each axis of a coordinate system to being grouped into coordinate tuple form.

Claim 85 (original): The system of claim 84, further comprising:

a data decompression module that decompresses the stored differences using an entropy based decompression algorithm.

Claim 86 (canceled)

Claim 87 (original): The system of claim 84, wherein the geometry decompression module predicts offset vertices by:

selecting a reference vertex on the reference model and a corresponding offset vertex;

selecting a basis coordinate system on the reference model with respect to the reference vertex, the basis coordinate system defined by vertices nearby the reference vertex, the basis coordinate system providing the basis coordinates for the reference vertex;

selecting a basis coordinate system on the offset model;

determining a position of the reference vertex in the basis coordinate system; and

predicting the offset vertex by applying the position of the reference vertex in the basis coordinate system on the reference model to the basis coordinate system on the offset model.

Claims 88 – 101 (canceled)